REMARKS

New claims 40-44 have been added. The claims remaining in the application are 1-44.

Rejection Under 35 U.S.C. § 103

The Office Action has rejected claims 1-39 under 35 U.S.C. 103(a) as being unpatentable over Rhoads (U.S. 6,430,302) in view of Ramanujan et al. (U.S. 6,215,547) and Doany et al. (U.S. 5,517,340). This rejection is respectfully traversed.

The innovative nature of the applicants' invention relates to the nature of the encoded watermark that is provided by the applicant's apparatus and method. As described in the background section of the present application, the problem that is addressed by the applicants' method and apparatus is watermark application during fabrication of the photosensitive medium itself.

Of particular interest in the present invention is the speed required. See page 2, lines 12-16. Pre-exposure of the film medium, see page 2, lines 20-23, during film manufacture calls for techniques and approaches that are not provided by conventional steganographic techniques, such as those disclosed by Rhoads. While the method of the applicants' invention could be applied during any point in film processing, the need for a watermarking technique that is particularly useful for high-speed processing of the film, at any stage, is highlighted in both the background section and in the detailed description of the invention. It is the requirement for a watermark that can be applied to a continuously moving medium that motivates the approach disclosed and claimed in the present application.

From a data aspect, the steganographic approach disclosed by Rhoads specifically requires some correlation between the watermark image and the image provided on the photosensitive medium. In the Rhoads method, a watermark is encoded as part of the image content, specifically designed to fit within the image area and to be hidden within the image thereby. It must be emphasized that this type of conventional steganographic approach can't be used for raw film as it is manufactured. While the ultimate location of an image frame on the film may be ascertainable during manufacture (such as by its likely location synchronous with perforations made on the edge of the film during

manufacture) the image content is unknown and is irrelevant to the method disclosed and claimed by the applicants. Using the method of the present invention, watermarking stripes can be exposed onto the film during manufacture or during later processing, wholly independent of the image content.

Both the Rhoads and Ramanujan et al. methods and apparatus provide an image, with or without a watermark, at discrete locations on the film, requiring that the film be stopped at the printing mechanism long enough to expose the image. It can be appreciated that this "stop and stare" technique, while necessary for image exposure, would be prohibitive if applied to high-speed film manufacture and processing. This would be particularly the case with the CRT writing device disclosed by Rhoads, since the inherent decay time of the CRT would prove prohibitive for forming a suitable watermark on a fast moving medium. For high-speed manufacture, the requirement to stop the film at each frame, expose a watermark, then advance the film to the next frame would be prohibitively costly and time-consuming. See, for example, the conventional approach of Figure 1 of the present invention. Thus, the applicants have disclosed and claimed a technique that allows the film to be continuously moving while a watermark pattern is encoded thereon.

Because the applicants' watermarking method exposes onto a continuously moving photosensitive medium, the problem of streaking must be addressed. Any application of the methods disclosed by Rhoads or by Ramanujan et al. to a continuously moving medium would necessarily result in streaking, which would render a conventional, image-based watermarking scheme to be unusable. The inventors have addressed this problem and actually employed a watermark method that intentionally forms and uses stripes running along the length of the photosensitive medium, whether these occur inside of or outside of any image frame that is subsequently or previously applied. By modulating groups of pixels to deliberately create strips in one or more color layers (Figures 4, 10a through 17, and 19), the present invention actively uses the motion of the moving film as a key factor in forming the characteristic watermark pattern that is desired. By varying either or both the number of pixels that form a spot (Figure 12) and the exposure interval (for example, in the graph of Figure 13b), the method of the present invention forms stripes that are independent of image frames or perforation intervals (page 13, lines 6–10).

Decoding the watermark data, particularly described with reference to Figure 4, also operates independently from any image content or perforation synchronization. In decoding, an integration process can be used to vertically integrate stripes written in specified columns on the film as it is projected. Thus, in both its encoding and decoding schemes, the spatially sparse watermarking method of the present invention differs pronouncedly from any techniques disclosed or suggested in the Rhoads or Ramanujan et al. disclosures.

Apparatus claims 1, 18, and 19 specify that the transport provide lengthwise displacement of the photosensitive medium during exposure. This connotes a different type of transport medium than would be used for apparatus disclosed by either Rhoads or Ramanujan et al., for which a transport medium would provide displacement to an exposure position, then arrest medium movement during the exposure interval before continuing. With this distinction in mind, in light of the Examiner's objection and with the purpose of more specifically defining the method and apparatus of the present invention, independent claims 1, 18, 19, 26, and 38 are amended to specify a continuous lengthwise displacement of the medium during exposure for both apparatus and methods.

With specific reference to claim 10, there is no suggestion given in any of the cited Rhoads, Ramanujan et al., or Doany et al. patents to provide a heater (72 in Figure 6 and page 19, Table 1, and lines 18, 19) in an apparatus for exposing a latent watermark, to accelerate the risetime of LCD spatial light modulators (90a, 90b in Figure 6).

With specific reference to claims 11, 12, 33, and 34, there is no suggestion given in any of the cited Rhoads, Ramanujan et al., or Doany et al. patents to utilize only a fractional segment of the image forming surface of a spatial light modulator in an apparatus for exposing a latent watermark (Figure 8 and page 17, lines 3-18).

With specific reference to claims 13 and 14, there is no suggestion given in any of the cited Rhoads, Ramanujan et al., or Doany et al. patents to utilize monochrome illumination for latent watermark exposure (page 12, line 30 through page 13 line 6).

With specific reference to claims 15, 24, and 35, there is no suggestion given in any of the cited Rhoads, Ramanujan et al., or Doany et al.

patents to provide a drive circuit that pulses an LED at a higher current than its continuous current rating (page 15 lines 16-23).

With specific reference to claims 17 and 36, there is no suggestion given in any of the cited Rhoads, Ramanujan et al., or Doany et al. patents to arrange an exposure pattern as a rectangular set of pixels with a length direction corresponding to the medium displacement direction (page 23, line 22 through page 24 line 15).

With specific reference to claim 37, there is no suggestion given in any of the cited Rhoads, Ramanujan et al., or Doany et al. patents to arrange exposure patterns on first and second spatial light modulators to provide an interleaved watermarking pattern (page 24, lines 16-29).

The Doany et al. patent relates to a projection display, rather than to a printing exposure operation. It must be pointed out that there are significant differences between image display and image exposure. Display applications are concerned with brightness, color gamut, and image registration and do not need to address many of the problems faced in printing applications, such as high resolution imaging, exposure beam uniformity, and film response characteristics such as exposure time and film reciprocity failure. Thus, although the Doany et al. disclosure shows the use of two spatial light modulators to form an image, there would be no motivation to adapt these methods to the challenge of providing a watermark during high-speed motion picture processing.

Additional claims 40 through 42 are added to claim the watermark formed by the apparatus and method of the present invention and to more specifically claim the method described with reference to Figure 12.

CONCLUSION

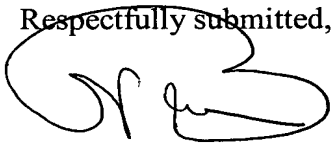
Dependent claims not specifically addressed add additional limitations to the independent claims, which have been distinguished from the prior art and are therefore also patentable.

In conclusion, none of the prior art cited by the Office Action discloses the limitations of the claims of the present invention, either individually or in combination. Therefore, it is believed that the claims are allowable.

If the Examiner is of the opinion that additional modifications to the claims are necessary to place the application in condition for allowance, he is

invited to contact Applicant's attorney at the number listed below for a telephone interview and Examiner's amendment.

Respectfully submitted,



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If the Examiner is unable to reach the Applicant(s) Attorney at the telephone number provided, the Examiner is requested to communicate with Eastman Kodak Company Patent Operations at (585) 477-4656.